CASE REPORT

A RARE COMPLICATION: TRACHEAL LACERATION AFTER ROUTINE INTUBATION AT THE TAMALE TEACHING HOSPITAL

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Abstract

Patients Tracheal perforation is a rare complication of endotracheal intubation that usually presents as a linear lesion in the membranous wall of the trachea. It is more prevalent in women (because they have shorter stature and a weaker pars membranosa compared to men), patients 50 years and older and patients less than 160 cm tall. Most common clinical manifestations include subcutaneous emphysema, pneumomediastinum, pneumothorax, respiratory distress and haemoptysis. We report the case of a young male presenting with tracheal perforation after routine endotracheal intubation. This case was managed conservatively without complications. Possible causes for the injury include: over-inflation of the endotracheal tube cuff, intubation by an inexperienced anaesthetist or use of an inappropriately sized tube for the patient. Clinical suspicion must be followed by diagnostic confirmation, which was achieved by direct visualization of trachea rupture on bronchoscopy. We therefore encourage endotracheal tube cuff pressure monitoring during general anaesthesia and direct supervision of an inexperienced anaesthetists during critical events such as induction and intubation.

Key Words: Trachea, Intubation, Perforation, haemoptysis, pneumomediastinum, pneumothorax, subcutaneous emphysema

Introduction

Tracheal perforation is a rare, yet life threatening complication of endotracheal intubation[1,2]. The incidence of tracheal rupture after endotracheal intubation is approximately 0.005%[3]. A seemingly uneventful intubation can result in injury to the trachea, which often manifests as haemoptysis and subcutaneous emphysema[4]. We report the first diagnosed case of post-intubation tracheal perforation under general anaesthesia in a 42 years old male at the Tamale Teaching Hospital in Ghana, a tertiary health facility that averages approximately 3651 endotracheal intubations per year.

Case Report

A 32-year-old man weighing 65.9 kg with a height of 150 cm underwent an emergency appendectomy under general anaesthesia in our facility. The patient's medical history was unremarkable and no abnormal laboratory results were recorded. He was classified as a class IE on the American Society of Anaesthesiology (ASA) physical status classification system, with a Mallampati score of I. Induction was smooth with an easy orotracheal intubation (Cormack 1, 1st attempt) using a single lumen internal diameter 7.0 mm cuffed tracheal tube. Neither the cuff nor the quality of the tube was in question. A high-volume low-pressure cuff was employed. This was performed by an anaesthesiologist with less than one year of working experience. No stylet was employed to aid intubation. At the end of an uneventful appendectomy lasting 50 minutes, the patient responded to verbal commands and showed sufficient spontaneous respiration. The oral cavity was suctioned retrieving very scanty saliva which was not blood stained. The anaesthesia team then proceeded to extubate the patient. The cuff was deflated and the patient immediately presented with a vigorous, incessant cough with haemoptysis seen in the endotracheal tube. This was accompanied with a rapid decline in SPO2 values, tachypnea, tachycardia, diaphoresis and restlessness as well as added sounds on auscultation of the chest. We could not measure EtCO2 due to the absence of a capnography in the theatre. The cuff was then re-inflated and intravenous propofol was administered to achieve sedation for suction and bronchoscopy.

The orotracheal tube was exchanged for a 9.0 mm orotracheal tube to facilitate suction and bronchoscopy with a flexible scope. The 9.0 mm was used advisedly because one, the anaesthetist who performed the intubation confirmed the 7.0 mm tube was too small

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for him but because it was a short procedure he left it. Secondly the fibreoptic scope we had at our disposal was difficult to manipulate in a small size tube and thirdly, the exchanged tube was intubated by an experienced anaesthetist who confirmed easy intubation. Adrenaline 1:2000 was instilled via the orotracheal tube, which improved the haemoptysis and allowed visualization with a fibre optic bronchoscope. A longitudinal laceration of approximately 15 mm and erythema around the posterior part of the membranous portion of the distal third of the trachea was found. A chest X-ray revealed right pneumothorax, pneumomediastinum, diffused radio-opacity which could be aspiration of blood and subcutaneous emphysema. A follow-up chest CT-scan performed six days post-injury revealed a persistent right pneumothorax, pneumomediastinum, bilateral pulmonary haemorrhage as well as an irregularity in the posterior wall of the tracheal (Fig. 1).

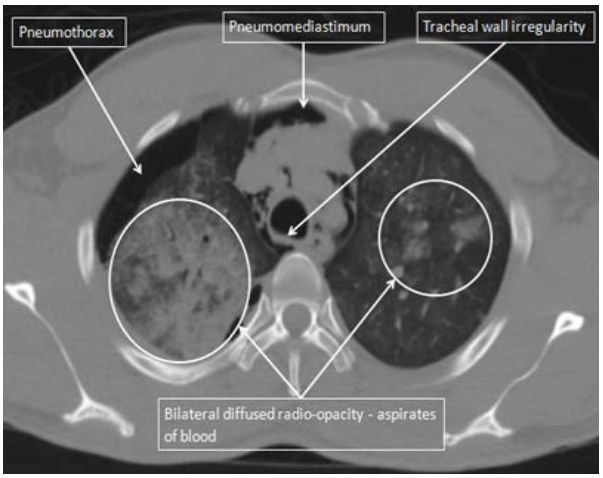

Figure 1. Chest CT scan demonstrating right pneumothorax, pneumomediastinum, bilateral pulmonary haemorrhage and an irregularity in the posterior wall of the tracheal

The patient was nursed in the critical care ward and conservative management continued. Treatment consisted of positioning the tracheal tube cuff distal to the lesion i.e., a bridging manoeuvre (in order to keep the lesion under zero pressure and prevent widening of the injury during inspiration), continuous airway humidification, broad-spectrum antibiotics, sedation, cough suppression, parenteral nutrition as the patient was nil-per-os for seven days and chest physiotherapy. Management also included serial bronchoalveolar lavage to suction secretions and to determine the tube position as well as daily chest X-rays to monitor the progress of the pneumothorax. We also maintained a cuff pressure between 25 to 30 mm Hg by regular monitoring of the pressure with a manometer. On the six day the patient was successfully extubated under fibre optic bronchoscopy guidance which visualized a healed tracheal mucosa. He was transferred to the ward the seventh day and was discharged on the fourteenth postoperative day with significant improvements on the chest X-ray findings. Monthly follow-up for three months showed complete resolution of the injury and chest signs.

Discussion

There are a series of risk factors that contribute to post-intubation tracheal perforation, which may be divided into mechanical or anatomical factors. Mechanical factors include multiple forced attempts at intubation, inexperience of the health professional, endotracheal tube introducers that protrude beyond the tip of the tube, over inflation of the cuff (diffusion of nitrous oxide into the cuff), incorrect position of the tip of the tube, repositioning of the tube without deflation of the cuff, inappropriate size of tube, significant cough, and movements of the head and neck while the patient is intubated. The anatomical factors include congenital tracheal abnormalities, weakness of the pars membranosa of the trachea, chronic obstructive pulmonary disease and other inflammatory lesions of the tracheobronchial tree, diseases that alter the position of the trachea (mediastinal collections, lymph nodes, or tumours), chronic use of steroids, advanced age, and female sex[2,5,6]. In this case, we suspect that the cause of the tracheal injury was over-inflation of the cuff because intubation was relatively easy without the need of a stylet. There were no identifiable congenital or anatomical factors that could have contributed to the injury. Post-intubation tracheal rupture is more frequent in the female sex and patients above 50 years of age. However our patient is a young man of a short stature, which is a risk factor for post-intubation tracheal rupture[2,6].

Moreover, tracheal injury by stylet damages the anterior mucosal layers of the trachea as the stylet is curved anteriorly[6]. However, in the presented case, as confirmed by fibre optic bronchoscopy, longitudinal rupture of the posterior membranous wall of the trachea was observed. Additionally, manual palpation of the pilot balloon was the technique employed to measure the cuff pressure. However previous studies have suggested that cuff pressure is usually under-estimated by manual palpation[7]. Subcutaneous emphysema is the most common clinical manifestation of tracheal perforation followed by pneumomediastinum, pneumothorax, dyspnoea/respiratory distress, and haemoptysis. Less common symptoms include pneumopericardium, angina, hypotension, and shock. Usually, these symptoms appear during surgery or in the immediate postoperative period[2,5,6]. In this case, the patient presented with haemoptysis and a cough that led us to perform bronchoscopy, a chest X-ray and a chest CT to confirm suspicion of a tracheal laceration.

Bronchoscopy was used to confirm the diagnosis of tracheal rupture and provide direct visualization of the lesion. This procedure provides evidence of the exact

site and extension of the lesion, helps to plan the therapeutic approach, and can be used to reposition the tube or allow reintubation with correct positioning of the tube if this is necessary. Tracheal rupture is usually longitudinal and is most frequently located in the pars membranosa, the posterior part of the trachea that lacks cartilaginous support[2,5]. Although a chest CT can provide valuable information[2,5] we did not find it provided any additional information from what was revealed by bronchoscopy and the chest X-ray except for the irregularity in the posterior wall of the trachea. A CT scan was performed on the sixth day after the event because the only scan in the hospital and for that matter the region was undergoing repairs work and was successfully fixed on that day. The objective was to rule out any additional injury not revealed by the chest x-rays and bronchoscopy. Presently there is no consensus on the treatment modality of tracheal perforation or laceration, although it appears that a conservative approach is associated with a better outcome. A publication by Minambres E et al, which have looked at more cases showed that a conservative approach showed improved results as compared to a more aggressive surgical intervention[2,4,5]. Moreover, some series have demonstrated that surgical repair in critically ill patients is associated with a mortality rate of 71%[2]. Conservative management was our choice for this case because the rupture was small (15 mm), none progressive pneumothorax, pneumomediastinum and subcutaneous emphysema, non-progressive symptoms, stable vital signs and an absence of sepsis. These are the criteria cited by researchers as indications for conservative management[2,4,8].

Airway management is an essential skill for anaesthesia providers. The anaesthesia provider should have a comprehensive knowledge of intubation complications, techniques to minimize the risks, an ability to identify complications and treatment modalities should a complication occur. This complication could have been avoided had the anaesthetist used a bigger (>7.5 mm) orotracheal tube with a low pressure cuff. Though a tube of high volume low pressure was used, 7.0 mm was too small for him requiring high volume to make a good seal. This, coupled with the absence of a manometer to measure the pressure may have contributed to this injury. (The manual palpation of pilot balloon was probably underestimated).

Supervision from experienced colleagues and measurement of the cuff pressure could also have prevented this injury.

We also recommend the use of bronchoscopy and a chest X-ray as the first line investigation method for diagnosis of tracheal injuries in low resource countries.

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